PUBLIC SERVICE COMMISSION
STATE OF WISCONSIN

Electric Transmission Lines

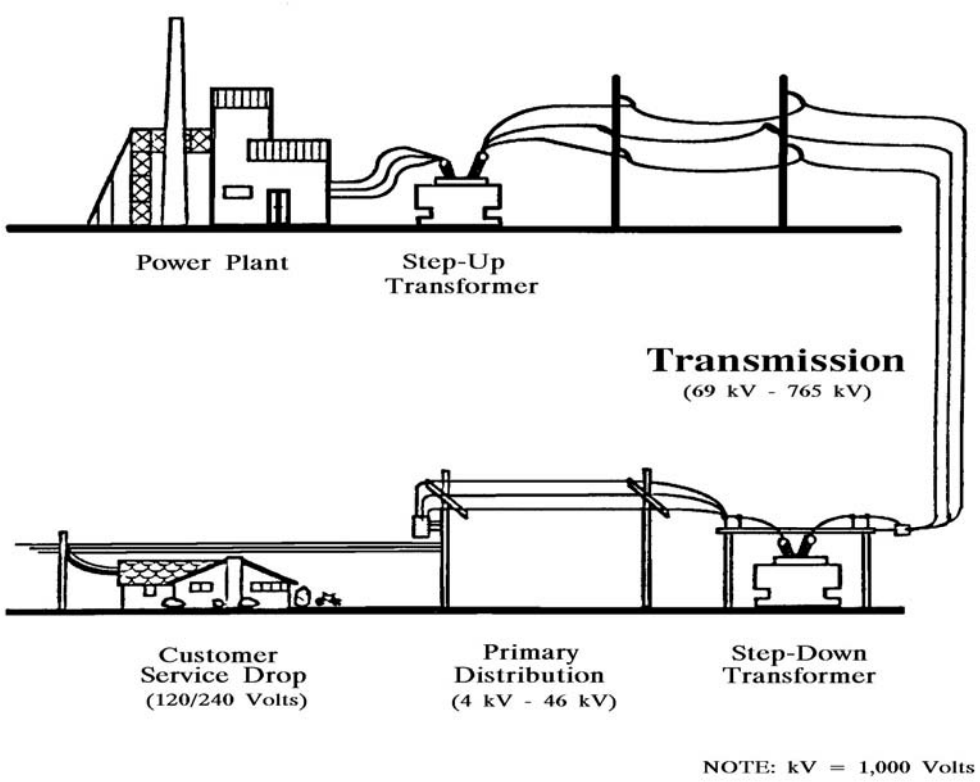
This overview presents basic information about electric transmission lines for landowners, government officials, and other members of the public who expect transmission construction in their area.

Electricity—From the Power Plant to the Customer

Electric lines transport electricity from power plants to customers. Figure 1 shows the electric system. The three types of electric lines are:

- Customer ***service connections***, which operate at a few hundred volts and serve several customers.
- Local ***distribution lines***, which operate at a few thousand volts and serve several thousand customers.
- ***Transmission lines***, which may operate at several hundred thousand volts and serve several hundred thousand customers.

Figure 1 Simplified electrical system



The lines that generate the most public interest are transmission lines. These are the largest and most visible electric lines. They operate at the highest voltages and can carry the most power. A large transmission line may supply the electric needs of a large city. Most large cities require several transmission lines for reliable electric service.

Transmission lines throughout Wisconsin and the surrounding states form a regional transmission "network." This network operates as one system. Power flows over lines, regardless of ownership, to provide energy wherever it is needed.

In a typical year, about 100 to 200 miles of transmission lines are built or upgraded in Wisconsin.

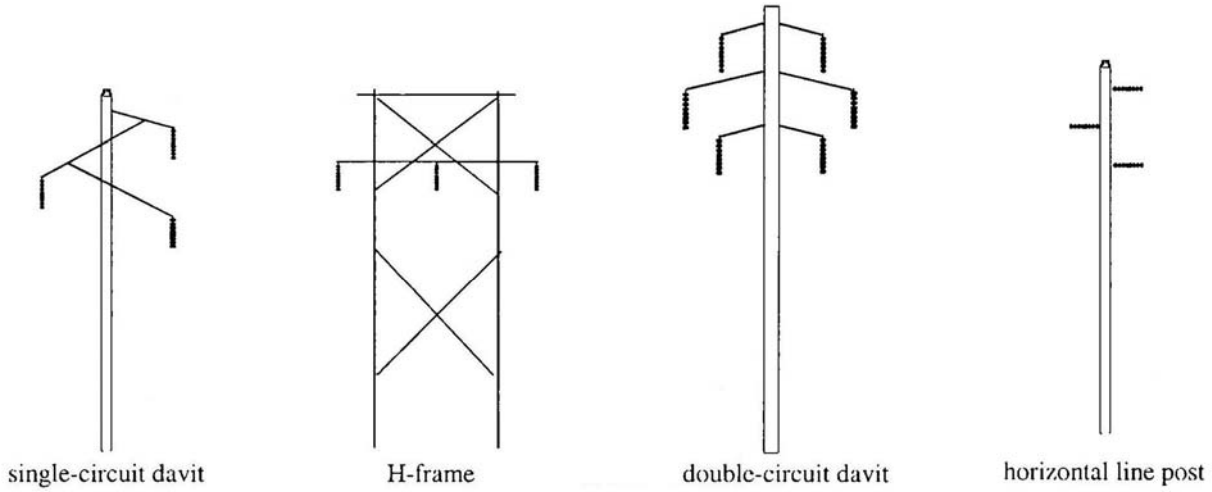
This overview presents information about transmission lines and the PSC review and approval process.

Transmission Line Design

Transmission lines are usually much larger than the more common distribution lines that run along rural roads and city streets. Transmission line poles, or structures, are between 60 and 140 feet tall; distribution line poles are around 40 feet tall. Figure 2 shows typical transmission structures used for new lines.

On a transmission structure, the three large wires, called conductors, carry electric power. They are usually about an inch in diameter. There also is a smaller wire at the top of the structure, called the shield wire, which protects the power line from lightning. Occasionally, utilities design a transmission structure to carry two separate sets of transmission lines. This "double-circuit" structure carries six conductors and one or two shield wires.

Figure 2 Typical electric line structures in Wisconsin



The "design voltage" of a transmission line typically ranges from 69,000 volts to 345,000 volts. The term "kilovolt," or "kV," stands for 1,000 volts. The highest transmission voltage in Wisconsin, 345,000 volts, is usually referred to as 345 kV. Higher voltage lines are found in other areas of the U.S.

Transmission Line Needs

The need for new transmission lines is generally linked to growth in the use of electricity. This means that:

- The existing transmission system must be reinforced with new lines to prevent equipment overloads and low voltages.
- New power plants may need to be built, with new transmission lines to connect them to the existing transmission system.
- Older transmission lines that are in poor condition and no longer reliable might need to be replaced by new lines. Often these new lines will have a greater electricity carrying capacity than those they replace.

In 1992, the PSC recognized "power transfer capability" as an acceptable reason for building new lines. Power transfer capability means the ability to transfer, or exchange, power between regions of the state or between Wisconsin and other states. This capability is over and above the capacity to transport and deliver electricity to "native" customers in a utility's service territory.

Benefits of power transfer capability can include:

- Increased transmission system reliability.
- Sale of "firm" power.
- Sale of non-firm "economy" power when market prices are favorable to both parties.
- Exchange of power during emergencies.

Changes in Transmission Use

A number of recent developments have altered the way that the transmission system is used and have created new organizations with roles in transmission operation and planning. The Federal Energy Regulatory Commission (FERC), a federal agency that regulates energy utilities, has ordered utilities to offer other energy providers fair and open access to their transmission lines. Many utilities have used this new access to others' transmission systems to expand their use of economical sources of power outside of their immediate areas. This has led to growing use of the transmission network, which increasingly runs up against limits on the ability of the existing system to transfer power.

As part of the broad movement across the industry to ensure that all parties can gain access to the transmission system on comparable terms, recent state legislation provided for a Wisconsin transmission company that would consolidate ownership of the transmission systems of a number of electric utilities in the state. This transmission company would then provide uniform access, pricing and operating policies over this entire area. The eastern Wisconsin electric utilities have transferred their ownership of transmission lines to this new transmission company, known as the American Transmission Company (ATC). The ATC is a regulated transmission-only public utility that is owned by the utilities that contributed their transmission facilities. Its rates for transmission service are regulated by the FERC and significant transmission construction projects require approval from the PSC.

Electric transmission in Wisconsin is now built and controlled by the ATC, Northern States Power Company (NSP), and the Dairyland Power Cooperative (DPC). NSP and DPC have not transferred ownership of their transmission lines, located in the western part of the state, to the ATC.

While formation of the transmission company was motivated in part by the desire to facilitate uniform system operation and consistent, fair transmission access standards over a broad area, an even larger umbrella organization is forming to further these goals. The Midwest Independent System Operator (MISO) is being formed by utilities in Wisconsin and several surrounding states. MISO will administer use of the transmission system in its service area and will direct the physical operation of the system by the individual transmission owners within MISO. The development of MISO was encouraged by the FERC, and state law requires that Wisconsin utilities, including ATC, participate in MISO.

PSC Role

The PSC is the branch of state government with the overall responsibility of regulating electric utilities and other developers of large electric facilities. While the federal government's involvement in regulation of the transmission system has increased, the PSC retains authority for regulating retail electricity service and for approval of significant construction projects. The PSC reviews all proposed transmission utility construction projects whose cost exceeds $5 million and issues a Certificate of Authority (CA) when they are approved to be built. New transmission lines with design voltages greater than 100 kV and longer than one mile (except lines less than 230 kV that are built entirely on existing transmission line right-of-way) require a Certificate of Public Convenience and Necessity (CPCN) from the PSC. The PSC considers alternative sources of supply and alternative locations or routes, as well as need, engineering, economics, safety, reliability, individual hardships and environmental factors when reviewing a transmission project. The CPCN review process also includes a public hearing in the affected project area. The CA review process does not automatically include a public hearing.

The PSC does have the authority to order a utility to construct transmission facilities if the PSC determines that the facilities are necessary to relieve a constraint on the transmission system. Generally, however, transmission projects are proposed by the utilities that plan to build them. When applying for construction approval the utilities provide basic electrical, environmental and cost data for the proposed project and alternative transmission solutions.

Transmission Planning

Because the transmission system is an interconnected network that functions as one system, the utilities need to cooperate in planning power lines and substations. Utility engineers use computer simulation of the transmission system to assess the need for system upgrades. These simulations look several years into the future to test how transmission facility outages (caused by storms, for example) will affect customer voltages and electric power flows on other transmission lines. If these studies show that the transmission system is vulnerable to low voltages or line overloads in the future, the utilities will generally conclude that the transmission system must be reinforced. This may mean building new transmission lines or upgrading existing lines. The PSC monitors these plans, but the MISO will ultimately have responsibility for coordinating transmission planning among all transmission owners within the MISO's boundaries.

Transmission Line Route Selection

The PSC selects a route when it issues an order granting a CPCN. It also selects a route when it issues an order granting a CA. The PSC can deny the CPCN or CA based on lack of need or lack of a viable route. The PSC can also direct an applicant to build for a particular voltage, to use a particular structure type, and to minimize environmental impacts.

Route Alternatives

The applicant provides information on more than one possible route in its application. Many applicants sponsor public meetings and base the proposed routes in their CPCN or CA application on information they gather at these meetings. In addition, data is gathered from public agencies, maps, air photos and driving and walking over the project area.

An applicant may or may not identify a preferred or proposed route. It must provide the PSC with equal information on all proposed routes, and the PSC, during its review, treats all the routes equally. The route finally chosen may be the applicant's preferred route, a combination of reasonable routes, a variation on a proposed route, or a route that was suggested by a member of the public.

Project and Route Approval

The PSC considers the need for a transmission system improvement and determines if a new line is the optimal solution. If it finds that it is, the PSC reviews the project area and the routing information and may consider other possible routes or transmission structures. The PSC considers the area that would actually be affected by each route, the quality of the existing environment, the types of impacts a power line would cause in this area, the degree of impact, and possible ways to minimize impacts.

For a more in-depth discussion of this issue, see the Overview "Environmental Impacts of Electric Transmission Lines."

The PSC looks for potential impacts to these resources and others: aesthetics, agriculture, airports and airstrips, archeological sites, cultural and social characteristics of the project area, endangered/threatened resources, forests, historic sites, property values, recreation areas, river crossings, safety, and wetlands. The PSC also examines the potential changes in magnetic fields that could result from the project.

The PSC also looks into possibilities for locating the new lines near existing power lines, railroads or roads (this is called corridor-sharing). In addition, route choices may be affected by other factors reviewed by the PSC, such as transmission system reliability and costs.

Based on information gained from the review process and public comments, the Commission decides which route the new line will follow.

New Lines and Landowners

Easement Negotiations

The applicant or project developer will negotiate with landowners to obtain an easement on which to build the power line. There are a number of laws and rules related to landowner rights (such as the right to prevent the use of herbicides to the power line right-of-way). For power lines under 100 kV, negotiations may begin before approvals are obtained from the PSC. For power lines 100 kV or over, a CPCN must first be acquired unless the line is in existing transmission right-of-way (ROW).

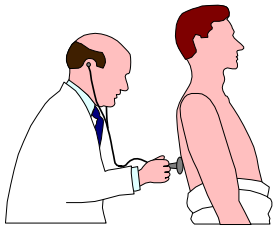
The Department of Commerce has jurisdiction over the utility easement negotiation process because utilities, including the ATC, have the power of eminent domain to build transmission lines. This means that a landowner cannot refuse to work out an agreement for an easement. The utility can take the landowner to court and have the court set the price for the easement and condemn land for the easement. Non-utility developers, such as independent power producers (IPPs), sometimes seek easements to build

transmission line connections to the utility system. IPPs and other non-utility developers do not have the authority to condemn private property. They must negotiate with willing sellers.

The PSC generally approves transmission line "corridors" or "routes" that are fairly precisely described. The PSC order may also set conditions for construction, such as placing structures as close to the road ROW as possible or working with the DNR to route a line through a wetland area. The PSC has no part in negotiations or in the exact placement of transmission structures. The PSC's objective is to provide direction, but to allow individual landowners and transmission builders the flexibility to work out specific details, related to individual circumstances and preferences.

For more information, refer to the Overview "Right-of-Way and Easements for Electric Facility Construction.

Human Health Impacts



Potential for shocks

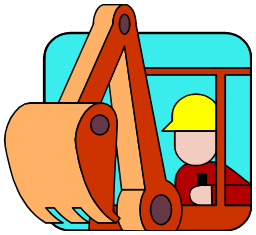
The National and Wisconsin electrical codes protect people and property from electrical shocks by providing standards for safe construction and operation of transmission lines.

Electric and magnetic fields (EMF)

Some scientific studies suggest there is a link between magnetic fields, which are generated by power lines as well as household wiring and appliances, and certain types of cancer. However, there is a scientific consensus growing that the potential for health risks from exposure to EMF is very small, because the epidemiological evidence is weak and a plausible biological mechanism cannot be found.

For a more in-depth discussion of this issue, see the Overview "EMF: Electric and Magnetic Fields."

Underground Transmission Lines



Small distribution lines are routinely buried. The burial of large transmission lines is less common because it is extremely expensive, from two to ten times more than overhead construction.

Over the long term, underground transmission cables may not be as reliable as overhead lines. It takes longer to locate and correct problems on underground transmission lines. A faulted line might be out of service for several days. Sometimes, a fourth cable must be added as a spare, or a whole second circuit must be included to guard against extended power loss.

Underground construction may result in greater environmental impact than overhead construction because of the extensive land clearing and excavation that may be required. Trees and bushes, for instance, must be kept away from an underground line. Their roots attract water from the soil around the line and reduce the soil's ability to wick the line's heat away to the air above. Small trees and bushes may be planted under overhead lines. Also, excavation for overhead lines is limited to the location of each of the overhead structures, rather than the entire length of the line.

There are three basic kinds of underground transmission construction most commonly used in Wisconsin: (1) in high-pressure, oil-filled pipe; (2) in high-pressure, gas-filled pipe; and (3) as solid polyethylene-coated cables either buried directly or inside PVC ducts encased in a concrete envelope. Each has

advantages and disadvantages. Oil-filled pipe construction has an additional environmental problem associated with the potential for oil leaks into the surrounding soil and water.

For all these reasons, underground transmission construction is generally favored only in heavily congested urban areas, or where there is not enough room for overhead construction, or near airports where overhead transmission wires and poles could interfere with the safe landing and take-off of airplanes.

For further discussion of this subject, see the Overview "Underground Electric Transmission Lines."

Alternatives to New Transmission Lines

Some low-voltage problems can be corrected by installing special devices that regulate the voltage in an area and automatically respond to sudden low voltages caused by transmission line outages. Some line overloads can be corrected by installing larger conductors on an existing line. One option for deferring or eliminating the need for new transmission lines is Targeted Area Planning.

Targeted Area Planning

Targeted Area Planning (TAP) is a planning process that uses detailed local information on electric usage and that considers all potential locally-sited resources to meet local energy service needs economically with the smallest environmental footprint. This approach is in contrast to traditional planning which relies on large, central power plants and large transmission lines to get power to local areas.

TAP can be effective in delaying or eliminating the need for new power lines where power line need is driven by localized load growth and not "age and condition" of lines or the need for bulk energy transfer. TAP requires more detailed, area-specific information and considers a variety of resources, such as:

- Targeted DSM to promote energy efficiency.
- Locally-sited renewable generation.
- Locally-sited fossil fuel generation.
- Education to change customer usage patterns.

TAP may have economic and environmental advantages, but it requires a large amount of local data. The PSC has ordered that all future transmission projects should be screened to determine which projects are appropriate for Targeted Area Planning.

Public Input on Proposed Power Lines

The PSC actively solicits comments from government officials and the public on:

- The existence and location of resources in a power line project area.
- Potential power line routes.
- Concerns about potential impacts.

For all CPCN and most CA-level projects, the PSC notifies landowners along possible routes and asks for comments. Possible routes may change during PSC review of the case. These changes depend on the size of the project area and the complexity of the project. The routes proposed at a pre-application public meeting may not be the ones ultimately considered or approved by the PSC. Public input can affect the PSC decisions about a project.

Communicating with the PSC

Methods of getting information to or from the PSC for a particular project may include one or more of the following:

- Calling a PSC contact person (for each project, the name is provided to you in a letter or public notification).
- Writing a letter to the PSC contact person.
- Talking to a PSC staff person at a public information meeting (whether it is sponsored by the utility or the PSC).
- Writing a comment letter on a draft Environmental Impact Statement (EIS).
- Providing testimony at a PSC hearing.

PSC hearings

Not all electric transmission cases require PSC hearings. However, for cases that do require hearing, anyone with a point to make should testify at the hearing in order to have that point considered in the PSC's decision. When a PSC hearing is held, the decision must be based only on the information in the testimony or exhibits of the hearing (these are called the "hearing record"). Discussion and comment letters are not part of the record and cannot be used as a basis for the decision. PSC hearings are generally in the project area to accommodate public testimony.

Environmental Impact Statement

Few transmission construction cases require an EIS, but all cases are given some level of environmental review. If there is a hearing, PSC staff testifies about environmental issues. If an EIS is required, it becomes an exhibit in the hearing record.

Communicating with the applicants as well as the PSC

When looking at possible routes for power lines, most applicants seek information or comments from local government officials and landowners. Some sponsor public meetings before making the final application for PSC approval. After the application is filed, then the PSC begins its official review and request for public comments.

PSC Contacts for Further Information

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Madison, WI 53707-7854
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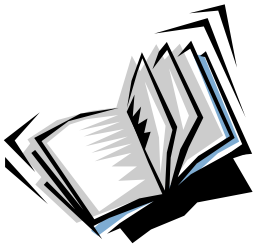
PSC Overview Series

The Public Service Commission has prepared other Overviews for important electric issues. These include:



- Air Quality Issues for Electric Power Generation
- Common Power Plant Siting Criteria
- Electric Energy Efficiency
- Electric Power Plants
- EMF—Electric and Magnetic Fields
- Environmental Impacts of Electric Transmission Lines
- Merchant Plants and Other Non-Utility Generation
- Nuclear Power Plant Decommissioning and Radioactive Waste Disposal
- Renewable Energy Resources
- Right-of-Way and Easements for Electric Facility Construction
- Underground Electric Transmission Lines

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